PROPOSED DEVELOPMENT OF WAREHOUSES AND A STORAGE FACILITY ON PORTION 250 OF FARM 745 GOEDGELOOF, ST. FRANCIS BAY.

Wetland Assessment

Prepared for Eco Route

by

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November 2023

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aquatic consulting & research

EXECUTIVE SUMMARY

Goedgeloof Properties (Pty) Ltd has applied for environmental authorisation for the construction of a warehouse and storage facility on Portion 250 of Farm 745 Goedgeloof, St. Francis Bay, in the Eastern Cape. A scoping assessment of the property indicated the possible presence of wetlands within the property boundary. Confluent Environmental was requested to visit the site and verify the presence of any watercourses on the property and, if so to assess the impact of the development as per the regulatory requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA).

The site visit revealed the presence of two larger depression wetlands (Wetland A and B), and a series of small excavations (3-5 m wide) in and around these wetlands. Visual observations during the site visit, together with the analysis of historical imagery confirmed that the site was historically used as a quarry to mine calcrete. Based on the weight of evidence, it is therefore most probable that the wetland depressions observed on site are artificial and have been created as a result of historical excavation and disturbance of the site. The wetlands are therefore classified as artificial depression wetlands characterised by temporary (or intermittent) periods of inundation and saturation. While the ecological importance of wetlands A and B is low, they are moderately important in terms of their hydro-functional attributes and could provide a useful function with respect to attenuating stormwater runoff.

The initial site plan was drafted prior to the confirmation of any aquatic features on site and includes an open space which is planned through the middle of the property with the primary aim being to attenuate stormwater runoff generated from the site. The proposed site development plan does cover large sections of both Wetland A and B and is referred to as Alternative 1. As part of the impact assessment, the author of this report has proposed an alternative (Alternative 2), which involves adjusting the layout such that the planned open space overlaps with the existing artificial wetland habitat (i.e. shifting the open space further to the north), with the aim being to preserve the existing artificial wetland habitat and using it to receive and attenuate stormwater input from the development. Loss of wetland habitat under Alternative 1 was assessed as moderate, while impacts associated with Alternative 2 are minor to negligible.

For this reason, it is recommended that Wetland A and Wetland B be retained and incorporated into the planned open space of the development as a stormwater attenuation area. Alternative 2, as proposed in this study is therefore recommended as the preferred alternative. Under this alternative, impacts are negligible (assuming implementation of mitigation measures) and represents a more ecologically sensitive option in comparison to Alternative 1, which will result in loss of most of the current area of Wetland B. Given their very limited ecological importance and sensitivity, the loss of any of the small excavations that fall outside of the buffer for Wetland A and B is considered to be acceptable from a freshwater biodiversity perspective. As the wetlands are artificial, no water use authorisation is required

DECLARATION OF SPECIALIST INDEPENDANCE

- I am registered with the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I undertake to disclose all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;
- I have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- All the particulars furnished by me in this document are true and correct.

Specialist: Dr. James Dabrowski (Ph.D., Pr.Sci.Nat. Water Resources)

Date: November, 2023

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1. INTRODUCTION

Goedgeloof Properties (Pty) Ltd has applied for environmental authorisation for the construction of a warehouse and storage facility on Portion 250 of Farm 745 Goedgeloof, St. Francis Bay, in the Eastern Cape. A scoping assessment of the property indicated the possible presence of wetlands within the property boundary. Confluent Environmental was requested to visit the site and verify the presence of any watercourses on the property and, if so to assess the impact of the development as per the regulatory requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA).

1.1 Key Legislative Considerations

1.1.1 National Water Act (NWA, 1998)

The Department of Water & Sanitation (DWS) is the custodian of South Africa’s water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (NWA) (Act No. 36 of 1998) aims to protect water resources, through:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

For the purposes of this assessment, a wetland area is defined according to the NWA (Act No. 36 of 1998) as:

“Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

Wetlands therefore must have one or more of the following attributes to meet the NWA wetland definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

No activity may take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). According to Section 21 (c) and (i) of the National Water Act, an authorization (Water Use License or General Authorisation) is required for any activities that impede or divert the flow of water in a watercourse or alter the bed, banks, course or characteristics of a watercourse. The regulated area of a watercourse for section 21(c) or (i) of the Act water uses means:

a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

According to Section 21 (c) and (i) of the NWA, any water use activities that do occur within the regulated area of a watercourse must be assessed using the DWS Risk Assessment Matrix (GN 509) to determine the impact of construction and operational activities on the flow, water quality, habitat and biotic characteristics of the watercourse. Low Risk activities require a General Authorisation (GA), while Medium or High Risk activities require a Water Use License (WUL).

1.1.2 National Environmental Management Act (NEMA, 1998)

According to the protocols specified in GN 320 (Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when Applying for Environmental Authorisation), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool (screening tool). An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of:

- **Very High** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment; or
- **Low** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.

According to the protocol, prior to commencing with a specialist assessment a site sensitivity verification must be undertaken to confirm the sensitivity of the site as indicated by the screening tool:

- Where the information gathered from the site sensitivity verification differs from the screening tool designation of **Very High** aquatic biodiversity sensitivity, and it is found to be of a **Low** sensitivity, an Aquatic Biodiversity Compliance Statement must be submitted.
- Similarly, where the information gathered from the site sensitivity verification differs from the screening tool designation of **Low** aquatic biodiversity sensitivity, and it is found to be of a **Very High** sensitivity, an Aquatic Biodiversity Specialist Assessment must be submitted.

2. APPROACH

The assessment of the suspected wetlands followed several approaches which include:

- A desktop assessment was conducted to contextualize the affected wetlands in terms of their local and regional setting, and conservation planning. An understanding of the biophysical attributes and conservation and water resource management plans of the area assists in the assessment of the importance and sensitivity of the wetlands, the setting of management objectives and the assessment of the significance of anticipated impacts. The following data sources and GIS spatial information were consulted to inform the desktop assessment:
    - National Freshwater Ecosystem Priority Area (NFEPA) atlas (Nel at al., 2011);
    - National Wetland Map 5 and Confidence Map (CSIR, 2018);
    - DWS hydrological spatial layers.
- Review of historical topographical maps and aerial photographs (obtained from the Chief Directorate: National Geo-Spatial Information (CDNGI) Geospatial Portal) to determine the historical presence of watercourses and assess changes to the site over time; and
- A site visit, which was undertaken on the 7th of June 2023, during which time any watercourses were classified and delineated according to Ollis et al. (2013) and DWAF (2005), respectively. In brief this assessment included:
    - A visual inspection of the area of interest to identify any specific landform types that could potentially indicate the presence of a wetland;
    - Identification of any hydrophilic plant species present; and
    - Soil augering to confirm the presence of soil indicators that may indicate the presence of a wetland.
- A follow up site visit was undertaken on the 10th of November 2023.

3. METHODS

3.1 Wetland Classification

The objective of the site visit was to identify and classify wetlands potentially affected by the development, and, if relevant, determine their Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS). Wetlands were classified based on their hydrological and geomorphological characteristics which provides a fundamental understanding of the drivers that characterize the wetlands and therefore assists in the interpretation of impacts to the wetlands. The classification of the wetlands also determines which PES and EIS assessment methodologies can be applied. Wetlands were categorised into discrete hydrogeomorphic units (HGMs) based on their geomorphic characteristics, source of water and pattern of water flow through the wetland. These HGMs were then classified according to Ollis et al. (2013).

3.2 Wetland Delineation

Wetlands were delineated according to methods described in DWAF (2005) as well as various desktop methods including the use of topographic maps, historical and current digital satellite imagery, and historical aerial photographs. The DWAF (2005) guidelines consider the following four specific indicators of wetland presence:

- The Terrain Unit Indicator: Identifies those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator: Identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation;
- The Soil Wetness Indicator: Identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation (i.e. mottling and gleying within 50 cm of the soil surface); and
- The Vegetation Indicator: Identifies hydrophilic vegetation associated with frequently saturated soils.

The following soil wetness indicators were used to identify/confirm zones of saturation in any suspected wetland areas:

- Temporary Zone: Short periods of saturation (less than three months per annum) characterised by few high chroma mottles and minimal grey matrix (< 10 %).
- Seasonal Zone: Significant periods of wetness (at least three months per annum) characterised by many low chroma mottles and a grey matrix.
- Permanent Zone: Wetness all year round characterised by a prominent grey matrix and few to no high chroma mottles.

3.3 Wetland Assessment

3.3.1 Present Ecological State

An important factor that influences the diversity and abundance of aquatic communities is the condition of the surrounding physico-chemical habitat. Habitat loss, alteration, or degradation generally results in a decline in species diversity and the PES is determined by assessing the extent to which habitat has degraded relative to the natural reference condition. The PES can therefore only be determined for natural systems. The PES cannot be determined for artificial systems as there is no reference condition against which to assess changes in habitat over time.

3.3.2 Ecological Importance and Sensitivity

The ecological importance of a watercourse is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Ecological sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh et al. 1988; Milner 1994). Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity. The EIS assessment methodology (Rountree and Kotze, 2013) applied to wetlands can be viewed in Appendix 1.

3.4 Impact Assessment

Development activities typically impact on the following important drivers of aquatic ecosystems:

- *Hydrology:* Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes and base flows and modifications to general flow characteristics, including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river etc.);
- *Geomorphology:* This refers to the alteration of hydrological and geomorphological processes and drivers, and associated impacts to aquatic habitat and ecosystem goods and services primarily driven by changes to the sediment regime of the aquatic ecosystem and its broader catchment;
- *Modification of water quality:* This refers to the alteration or deterioration in the physical, chemical and biological characteristics of water within streams, rivers and wetlands, and associated impacts to aquatic habitat and ecosystem goods and services (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication etc.);
- *Fragmentation:* Loss of lateral and/or longitudinal ecological connectivity due to structures crossing or bordering watercourses (e.g. road or pipeline crossing a wetland);
- *Modification of aquatic habitat:* This refers to the physical disturbance of in-stream and riparian aquatic habitat and associated ecosystem goods and services including the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.)*;* and
- *Aquatic biodiversity:* Impacts on community composition (numbers and density of species) and integrity (condition, viability, predator prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site.

Modifications to these drivers ultimately influence the PES and EIS of a watercourse. Accordingly, impacts to the wetlands were described and assessed based on their potential to modify each of the above-mentioned drivers of aquatic ecosystem health, using the PES (if relevant) and EIS of the wetland as a baseline against which to assess impacts. The impact assessment methodology is described in the appendix to this report (Appendix 2).

3.5 Sensitivity Mapping

Watercourses on or adjacent to the site were mapped in the field and verified at a desktop level using satellite imagery. A protective buffer zone was applied to watercourses potentially affected by the development. Buffer zones have been defined as a strip of land with a use, function or zoning specifically designed to act as barriers between human activities and sensitive water resources with the aim of protecting these water resources them from adverse negative impacts. Appropriate buffers were estimated based on buffer zone guidelines developed by Macfarlane and Bredin (2017). These guidelines estimate required buffer zone widths based on a combination of input parameters which include, *inter alia*, the nature of the activity and associated impacts, basic climatic and soil conditions and the implementation of appropriate mitigation measures.

4. LIMITATIONS

- The results of this study are based on two site visits conducted in June and November of 2023. While every effort has been made to assess the site as accurately as possible, seasonal variation could potentially affect the outcome of this assessment, particularly with respect to assessing the biodiversity associated with potential wetland areas.

- This assessment had to rely on historical imagery in order to determine whether observed wetlands are natural or artificial.

5. DESKTOP ASSESSMENT

The property falls within quaternary catchment K90E in the Kromme River Primary catchment area. The main river draining the catchment is the Krom River which merges with the Geelhoutboom River to form the Krom River estuary (Figure 1). The property falls within the South-Eastern Coastal Belt Level 1 ecoregion (20.2 Level 2), which is characterised by dune thicket vegetation and moderately undulating plains. The soil profile is sandy. Rainfall occurs all year round, with peaks during the summer months (Figure 2), with mean annual precipitation between 600 and 800 mm/year. The intensity of rainfall can be very high - however the sandy soils have a relatively low runoff potential which moderates the erosivity of soils in the area. The property is located on the outskirts of the town of St. Francis Bay within the industrial area. No watercourses (including rivers, drainage lines and wetlands) are indicated to occur on the property (Figure 3).

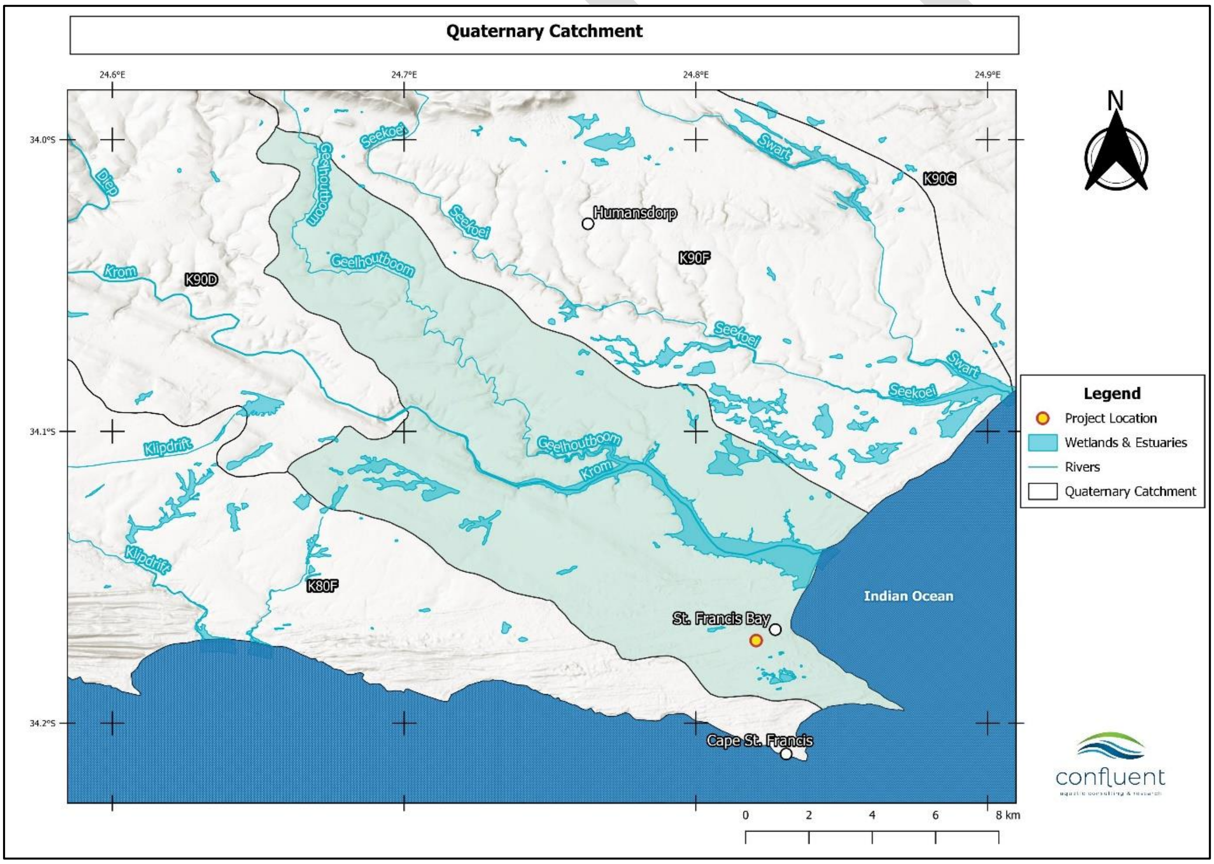

Figure 1: Location of site relative to mapped watercourses.

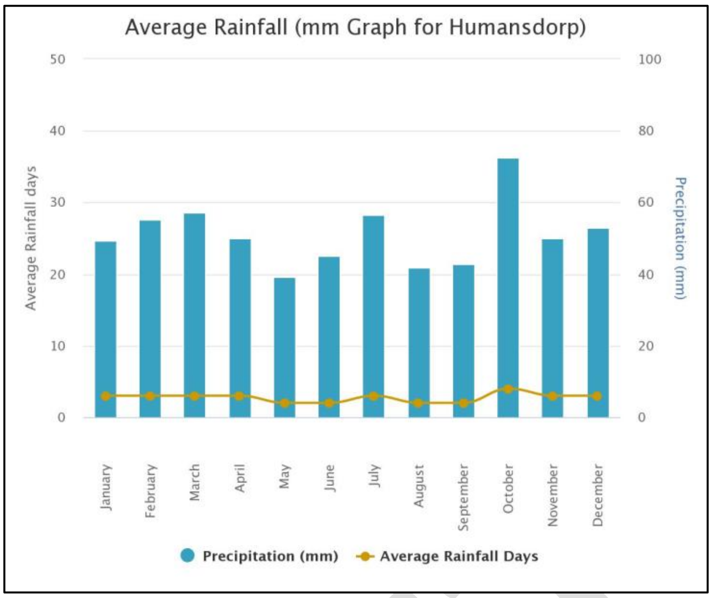

Figure 2: Average monthly rainfall for the town of Humansdorp.

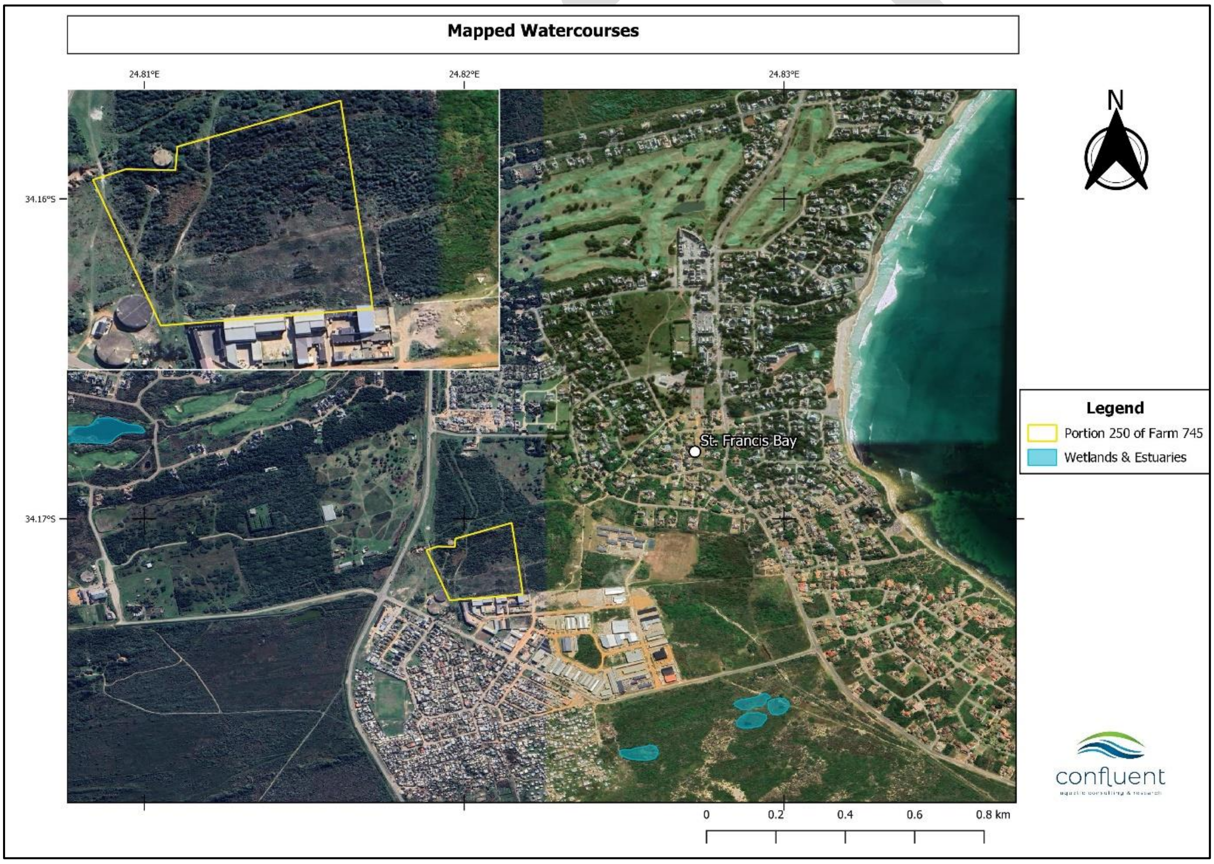

Figure 3: Map showing watercourses mapped on geospatial databases.

5.1 Freshwater Conservation and Management

5.1.1 National Freshwater Ecosystem Priority Areas

The property is located within sub-quaternary catchment (SQC) 9230 (Figure 4), which, according to the National Freshwater Ecosystem Priority Atlas (NFEPA, Nel et al., 2011), has not been classified as Freshwater Ecosystem Priority Areas (FEPAs). The catchment area therefore falls within an SQC that is not considered as being a priority for maintaining freshwater biodiversity at a national scale. This is largely as a result of the extensive agriculture that has occurred throughout most of the catchment area, which has led to the degradation of watercourses, particularly in their lower reaches.

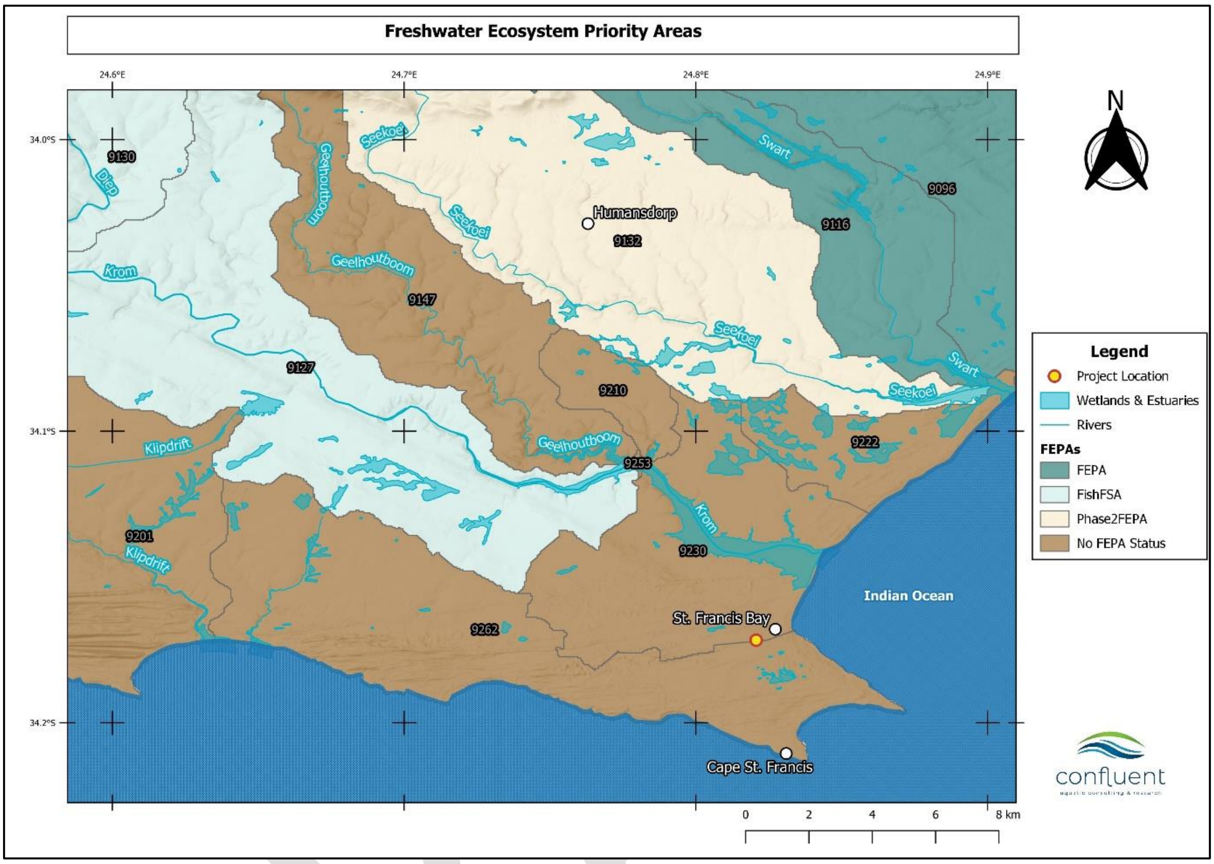

Figure 4: Map indicating the property location relative to Freshwater Ecosystem Priority Areas.

6. SITE VISIT

Apart from a higher lying vegetated dune running along the northern perimeter of the property, the topography is relatively flat, but does slope very gradually from the north and south to form a low-lying area across the middle of the property. To the west of the low-lying area there is a clear depression wetland (Wetland A) that is dominated by mainly *Typha capensis* (Figure 5 and Figure 6). The depression appears to have been created by a historical excavation into the soil profile and there was evidence of well vegetated stockpiles of soil around the perimeter of the wetland. A water pipeline that connects two reservoirs runs immediately adjacent to the western perimeter of the wetland, and according to the applicant, was the source of a significant water leak, which presumably contributed to the formation of the wetland habitat over time (Figure 7). This leak was reported to the municipality and has been subsequently repaired.

Further to the east there is a clear depression wetland area (Wetland B) that is well vegetated by terrestrial plants in and around the margins (Figure 5 and Figure 6). There were however signs of numerous wetland plant species that included *T. capensis, Ficinia nodosa, Carex clavate, Isolepis diabolica, Cyperus polystachyos* and *Centella asiatica*. Soil augering did not show any distinct indications of saturation in the soil profile. This is however not unexpected as very sandy soils typically do not show these indicators. The localised topography of the area and the presence of wetland plant species are therefore the most reliable indicators of the presence of a wetland. The depression was dry during the June site visit but was well inundated during the November site visit (Figure 7). In addition to these two large depression wetlands, there are several small depressions located outside of this larger depression area (Figure 5). These are all almost circular depressions, 3 to 5 m in diameter, with near vertical edges (approximately 0.5 to 1 m high) all dominated by *T. capensis.* Some of the depressions were located within the delineated extent of Wetland B and were at a noticeably lower elevation and were noticeably wetter than the surrounding wetland area.

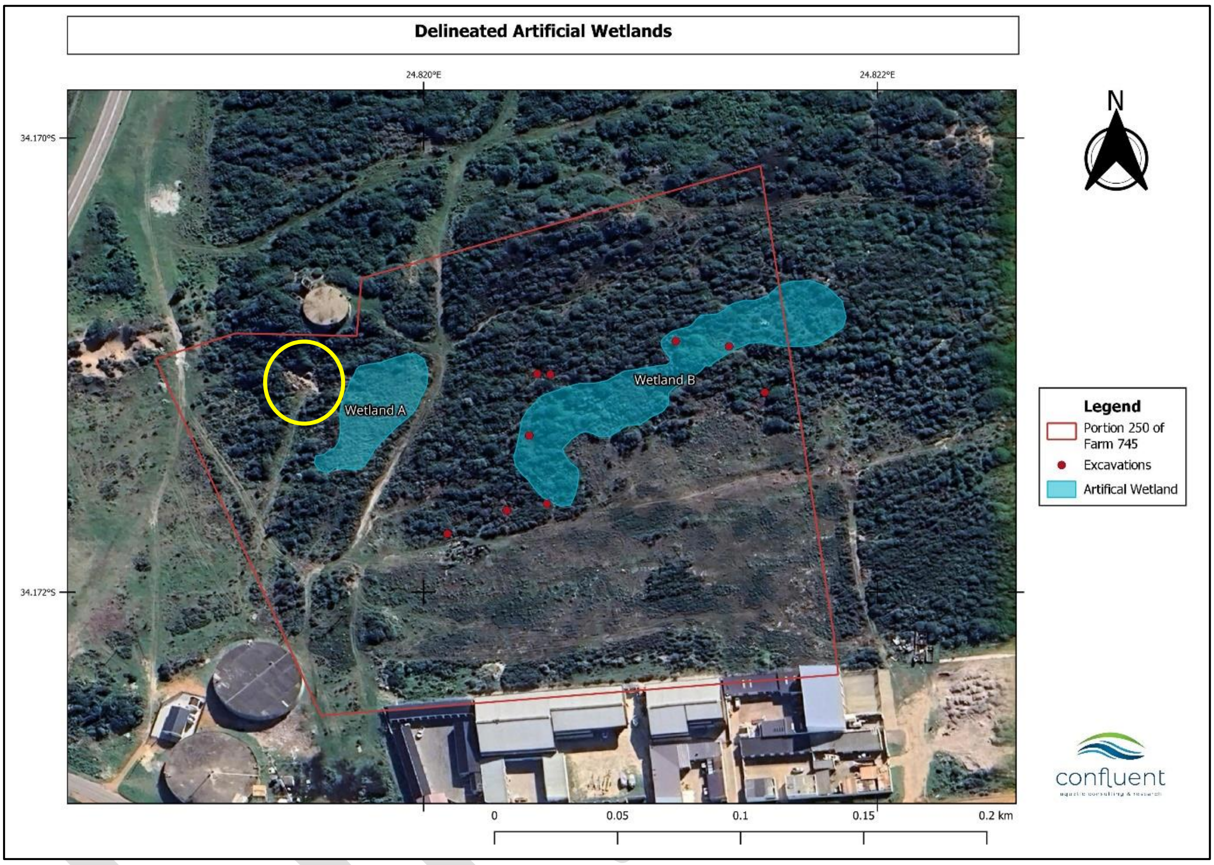

Figure 5: Map indicating delineation of artificial wetlands. The location where vegetation was cleared to repair the leak is indicated in the yellow circle.

Figure 6: Photographs of Wetland A (left) and Wetland B (right).

Figure 7: Stills from video footage obtained of the leak to the west of Wetland A. The *T. capensis* reed-beds from Wetland A can be observed in the background of the right image.

There were clear signs of excavations within and around the perimeter of the two wetlands. The northern perimeter of the Wetland B followed a clear vertical ridge of calcrete (approximately 1 m high) that represented the boundary of the wetland (Figure 8). Well vegetated stockpiles of soil and calcrete rubble were located in and around the perimeter of the wetland. According to the applicant, calcrete was historically mined from the property for the purposes of road construction. This was verified by analysis of historical aerial photographs obtained from the CD:NGI. In 1961, much of the site appears to be naturally unvegetated and appears to fall within the western most extent of an unvegetated dune system Figure 9). By 1968, as the town of St. Francis Bay began to establish, the extent of this unvegetated dune system had become much reduced in size and the majority of the property was covered in vegetation (Figure 10). There was however a small area that coincides with part of the present location of the existing wetland that appears to have been disturbed by quarrying activities (including an access road to the site from the east). By 1974, despite a noticeable increase in the density of vegetation of the surrounding area, the area of disturbance within the property had increased significantly and coincides well with the current extent of the wetland (Figure 11).

More recent satellite imagery clearly indicates that the location of some of the small depression wetland areas have been created by very recent excavations of the site and provides a good, recent example of how the larger wetland areas most likely formed. From 2003 to 2009 a series of excavations can be observed (Figure 12 to Figure 14). An image from 2012 clearly shows how these excavations filled with water following a period of high rainfall, which has most likely led to the establishment of wetland plant species in these small excavations (Figure

15). It is also evident from the 2012 image that Wetland B extended further to the west of the property boundary. This portion of the wetland area was however filled in during 2018 (Figure 16).

Visual observations during the site visit, together with the analysis of historical imagery therefore corroborate the fact that the site was used as a quarry to mine calcrete. Based on the weight of evidence, it is therefore most probable that the wetland depressions observed on site are artificial and have been created as a result of disturbance and excavations caused by mining. The wetlands are therefore classified as artificial depression wetlands characterised by temporary (or intermittent) periods of inundation and saturation.

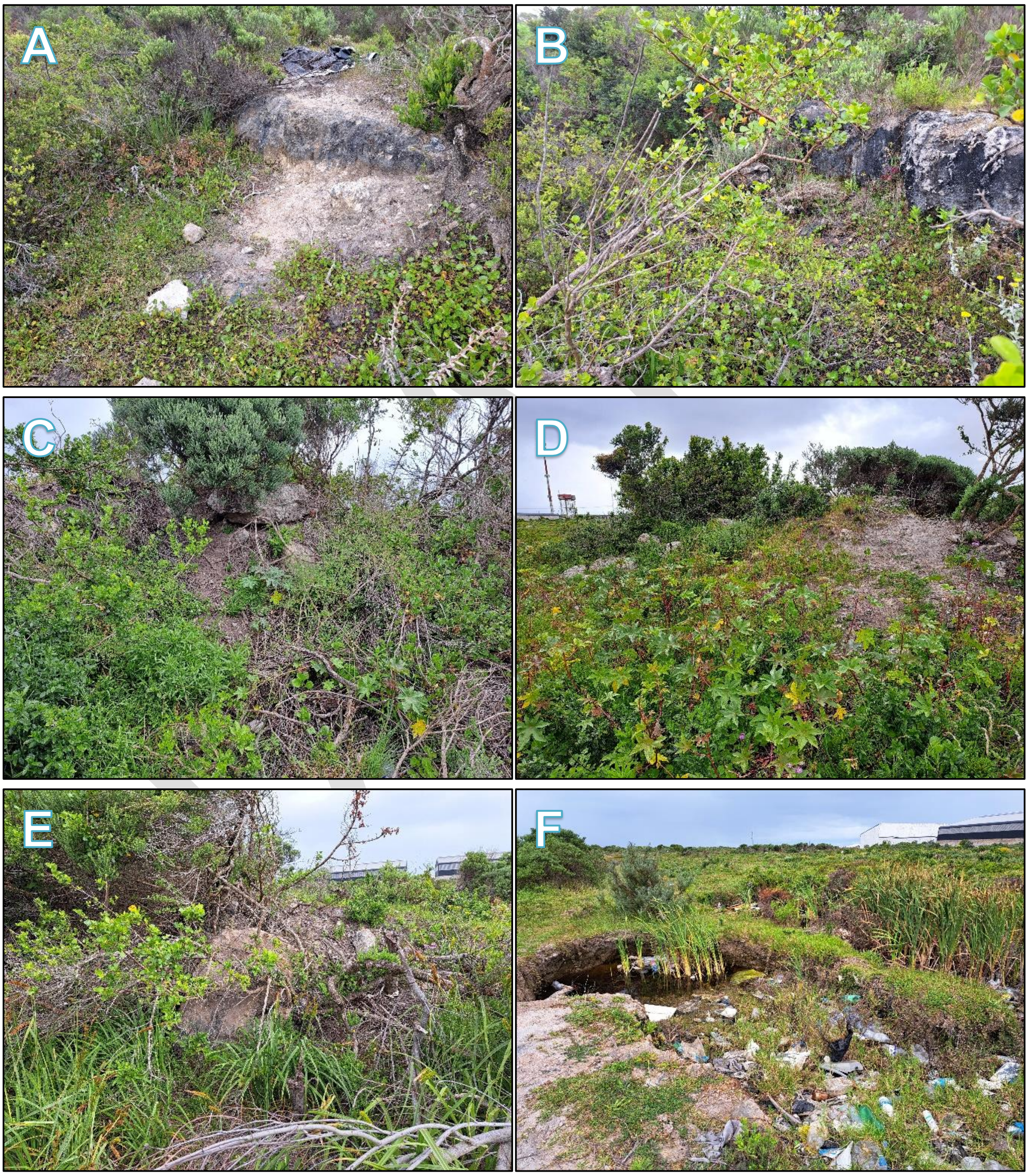

Figure 8: Photographs illustrating excavations into calcrete (A & B), vegetated stockpiles of excavated material around the perimeter of Wetland B (C to E) and one of several small excavations vegetated with *T. capensis* and filled with solid waste and litter (F).

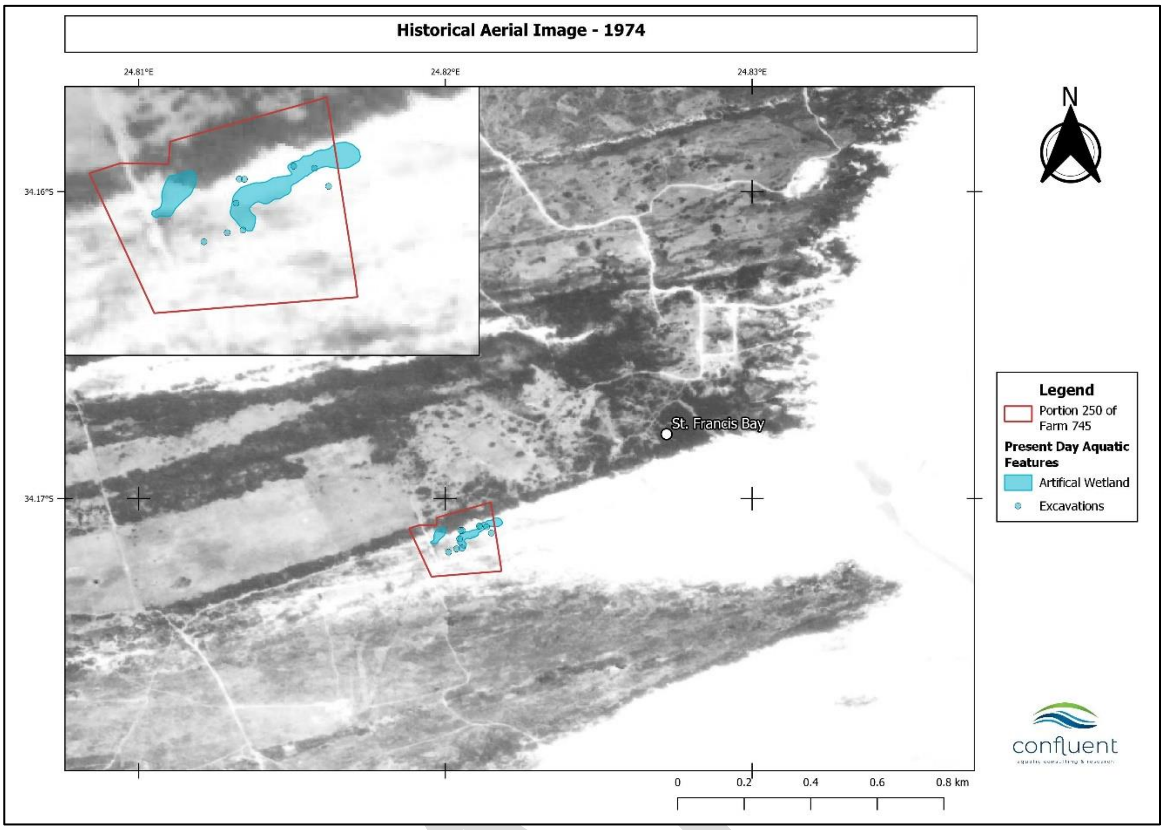

Figure 9: Map showing the present day location of artificial wetlands relative to historical activities undertaken during 1961.

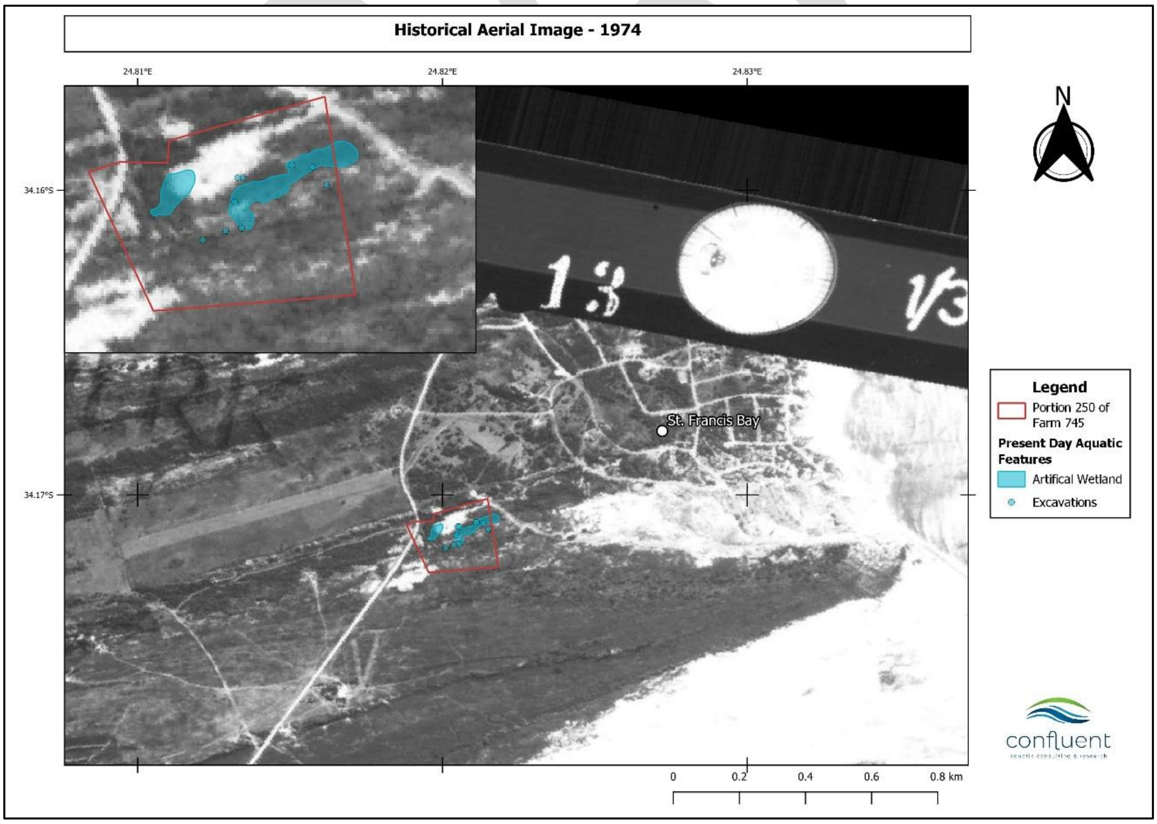

Figure 10: Map showing the present day location of artificial wetlands relative to historical activities undertaken during 1968.

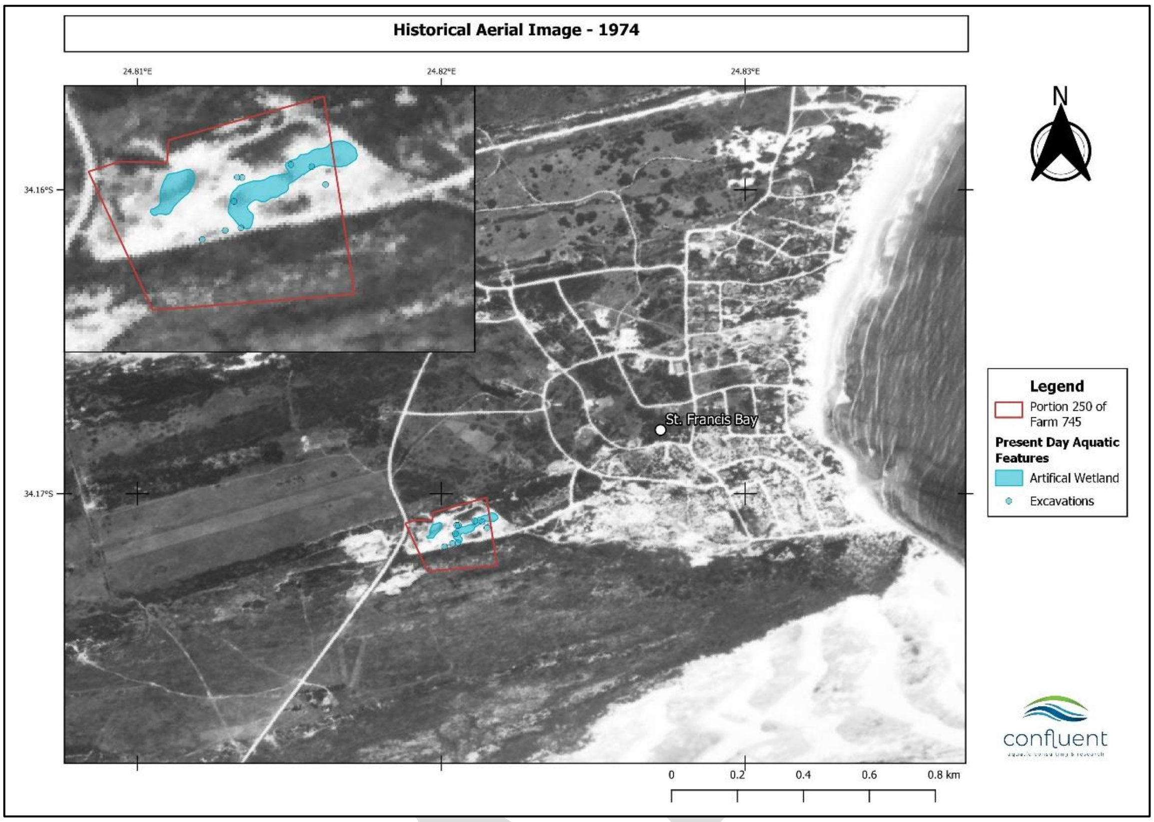

Figure 11: Map showing the present day location of artificial wetlands relative to historical activities undertaken during 1974.

Figure 12: Googler Earth image indicating excavation in 2003.

Figure 13: Google Earth image indicating excavation in 2006.

Figure 14: Google Earth image indicating excavation in 2009.

Figure 15: Google earth image indicating excavations inundated with water (2012).

Figure 16: Google Earth image indicating infilling of a section of the artificial wetland habitat (2018).

7. PRESENT ECOLOGICAL STATE

As the wetland has been confirmed as artificial, there is no reference condition against which to assess the PES. It is however worth noting the current conditions in and around the site. The site is generally quite degraded and there was evidence of large amounts of informal dumping and litter throughout the site Figure 17).

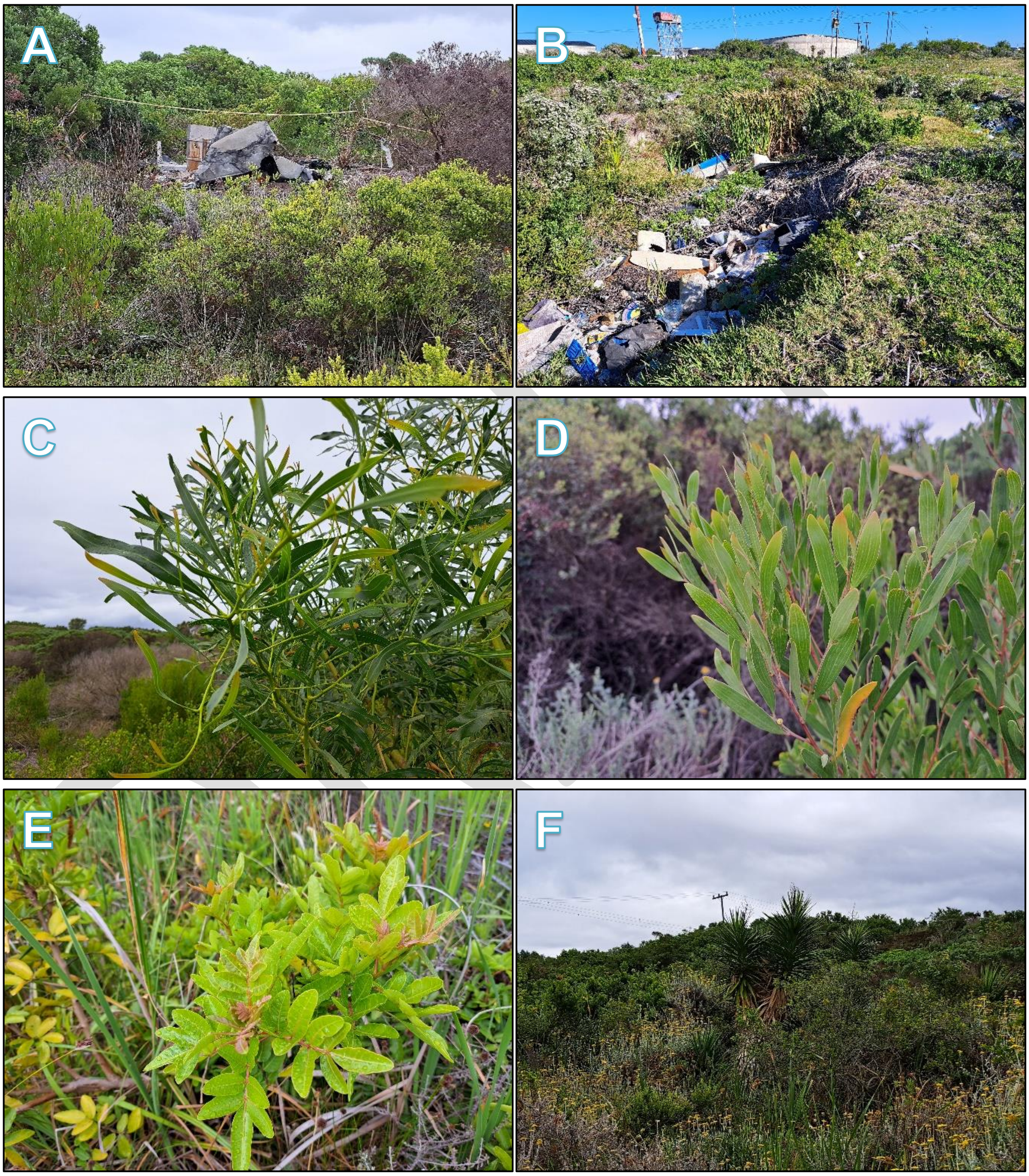

Figure 17: Photographs illustrating current impacts to the wetlands including temporary shelters (A), dumping and littering (B), *A. saligna* (C), *A. cyclops* (D), *S. Terebinthifolius* (E) and *A. sisalana.*

A satellite image from 2018 (Figure 16) indicates that large scale dumping historically occurred on the site. Several temporary rudimentary shelters were encountered throughout the wetland area. The smaller depressions provide very limited ecological function and, in some instances have been used for dumping of solid waste. It was also evident that the site is utilised by locals as an open defecation site. Alien invasive plant species that were observed on site included *Acacia cyclops* (Rooikrans), *A. saligna* (Port-Jackson), *Schinus terebinthifolius* (Brazilian Peppertree) and *Agave sisalana* (Sisal). Despite these impacts, the wetlands provide good habitat for a variety of wetland plants and biota (including amphibian and bird species).

8. ECOLOGICAL IMPORTANCE AND SENSITIVITY

While the wetland features are artificial, they may possibly fulfil an important ecological function, which should be assessed prior to developing the site. The Ecological Importance and Sensitivity (EIS – Rountree and Kotze, 2013) was therefore used to assess the artificial wetlands in terms of their ecological and hydro-functional importance and their ability to provide direct human benefits (see the Appendix for the methodological approach).

The wetland vegetation type associated with the area is the St. Francis Dune Thicket which is Least Threatened (Skowno et al., 2019). Given the relatively small size of the artificial wetlands and their temporary hydroperiod they are unlikely to be of significant ecological importance and provide limited habitat for aquatic biota (Table 1). Due to their artificial and temporary, endhoreic nature, the wetlands are not sensitive to changes in floods or flow conditions and are marginally sensitive to changes in water quality. Their temporary hydroperiod, endorheic flow pattern and isolation from a larger hydrological network provides no streamflow regulation function (e.g. sustaining flow during low flow periods) but does provide limited capacity for flood attenuation and assimilation of pollutants and nutrients derived from stormwater runoff (Table 2). Finally, their small size, temporary hydroperiod and low density of wetland plant species provides limited direct human benefits (Table 3). Overall, the EIS of the artificial wetlands can therefore be considered to be **Moderate**, based primarily on their hydro-functional attributes. The confidence in this assessment is very high.

While the larger depression wetlands are artificial, they now undertake a natural function and do provide habitat to aquatic biota and some hydro-functional attributes. For this reason, it is recommended that these larger wetlands be maintained within the development footprint. The small, isolated excavations offer negligible biodiversity or hydro-functional attributes and loss of any of these features is considered to be acceptable from a freshwater biodiversity perspective.

Table 1. Ecological Importance and Sensitivity importance criteria for the artificial wetlands observed on Portion 250 of Farm 745.

Ecological Importance and Sensitivity	Score 0-4	Confidence 1-5	Motivation
Biodiversity Support			
Presence of Red Data species	1	2	Low probability due to wetland being small and artificial and being located within a Least Threatened vegetation type.
Populations of unique species	0	3	Large populations of unique wetland species unlikely given small size and temporary hydroperiod.
Migration/feeding/breeding sites	1	4	Temporary breeding site for amphibians during temporary periods of inundation. Localised diversity of bird species.
Average	**0.66**	**3**	
Landscape Scale			
Protection status of wetland	0	5	Not formally protected and does not fall within an ESA or CBA.

Protection status of vegetation type	1	5	St. Francis Dune Thicket – Least Concern and Poorly Protected. Invaded by a variety of alien invasive plant species.
Regional context of the ecological integrity	0	4	Artificial depression wetland.
Size and rarity of the wetland types present	0	5	Small, artificial depression.
Diversity of habitat types	2	5	Low diversity – only one wetland type.
Average	**0.6**	**5**	
Sensitivity of the Wetland			
Sensitivity to changes in floods	0	5	Temporary artificial depression wetland – not sensitive to changes in floods.
Sensitivity to changes in low flows	0	5	Temporary depression wetland – not sensitive to changes in flow.
Sensitivity to changes in water quality	2	5	Temporary depression wetland – moderate sensitivity to changes in water quality.
Average	**0.66**	**5**	
ECOLOGICAL IMPORTANCE AND SENSITIVITY	**0.66 (Low)**	**5**	

Table 2: Hydro-functional importance of artificial wetlands observed on Portion 250 of Farm 745.

Hydro-functional Importance			Score 0-4	Confidence 1-5	Motivation
Regulating & supporting benefits	Flood attenuation		1	5	Limited attenuation of stormwater runoff.
	Streamflow regulation		0	5	Does not sustain streamflow.
	Water quality enhancement	Sediment trapping	2	5	Limited attenuation of nutrients and pollutants in stormwater runoff.
		Phosphate assimilation	2	5	
		Nitrate assimilation	2	5	
		Toxicant assimilation	2	5	
		Erosion control	0	5	Small temporary depression wetland – no erosion control.
	Carbon storage		1	5	Minor trapping of soil organic matter.
HYDRO-FUNCTIONAL IMPORTANCE			**1.25 (Moderate)**	**5 (High)**	

Table 3: Direct human benefit importance of artificial wetlands observed on Portion 250 of Farm 745.

Direct Human Benefits		Score 0-4	Confidence 1-5	Motivation
Subsistence benefits	Water for human use	0	5	Temporary inundation in urban area.
	Harvestable resources / cultivated foods	0	5	Too small with limited growth of harvestable resources to be of any value.
Cultural benefits	Cultural heritage	0	5	None.
	Tourism and recreation Education and research	0	5	None
DIRECT HUMAN BENEFITS		**0 (Low)**	**5 (High)**	

9. PROJECT DESCRIPTION

The initial site plan was drafted prior to the confirmation of any aquatic features on site and indicates the location of warehouses and storage units (Figure 18). An open space is planned through the middle of the property with the primary aim being to attenuate stormwater runoff generated from the site. The proposed site development plan does cover large sections of both Wetland A and B (Figure 19) and is referred to as Alternative 1. As part of the impact assessment, following consultation with the applicant, an alternative layout was drafted such that the planned open space overlaps with the existing artificial wetland habitat (including a 10 m buffer), with the aim being to preserve the existing artificial wetland habitat and using it to receive and attenuate stormwater input from the development (Alternative 2 - Figure 20).

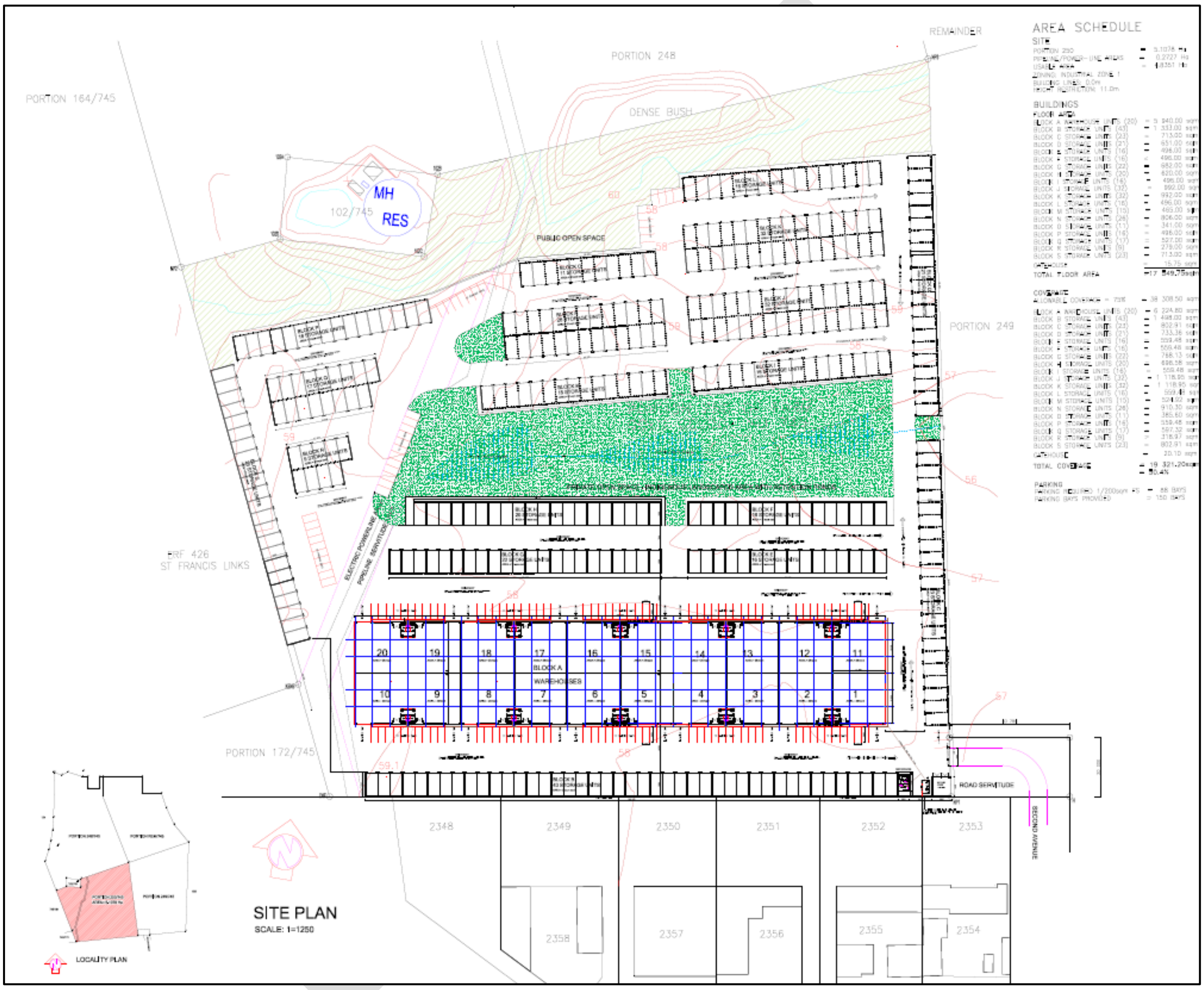

Figure 18: Proposed site development plan for Alternative 1.

confluent aquatic consulting & research

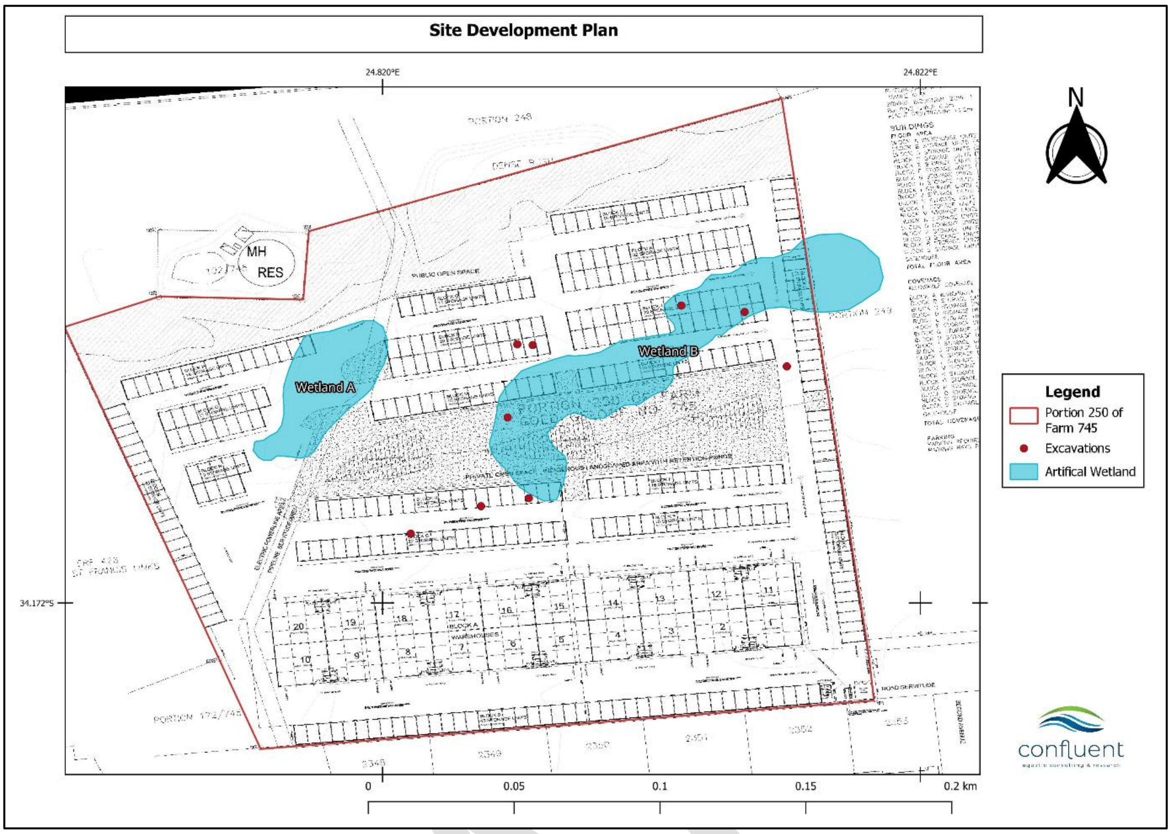

Figure 19: Location of artificial wetlands relative to the SDP.

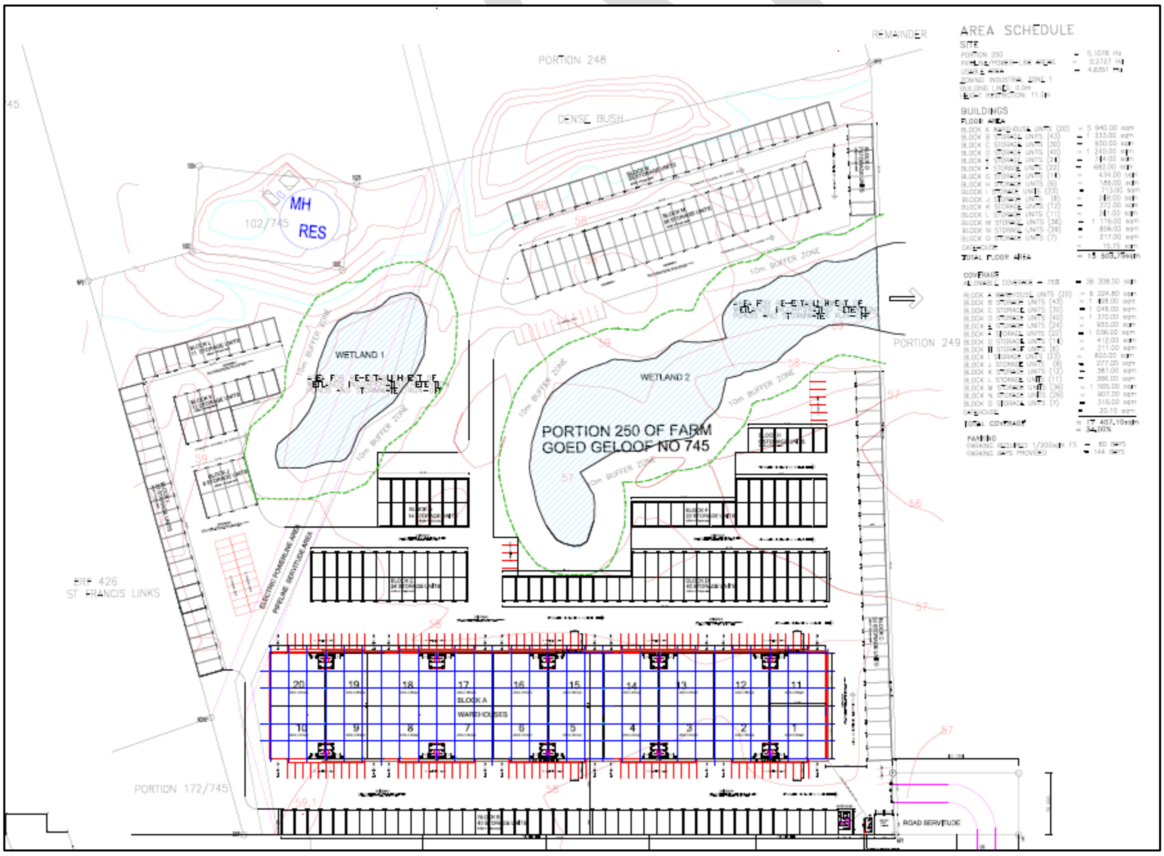

Figure 20: Proposed site development plan for Alternative 2.

10. IMPACT ASSESSMENT

Impact 1: Loss or disturbance to artificial wetland habitat caused by construction activities.

Alternative 1 will result in the loss of most of the existing wetland habitat and the creation of new artificial wetland habitat in the open space area which is planned to receive and attenuate stormwater. Alternative 2 will preserve the existing artificial wetland habitat by adjusting the layout such that the planned open space overlaps with the existing wetland habitat. Vehicles, heavy machinery and various construction activities (e.g. laydown areas and stockpiles) may however disturb wetland habitat under this alternative, which could in turn compromise the hydro-functional attributes of the wetland and any fauna and flora that have established in the wetland.

	Alternative 1		Alternative 2	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Moderate	Cannot be mitigated	Low	Very low
Duration	Permanent		Medium term	Brief
Extent	Limited		Limited	Very limited
Probability	Certain		Probably	Unlikely
Significance	**-91: Moderate**		**-36: Minor**	**-15: Negligible**
Reversibility	High		High	High
Irreplaceability	Low		Low	Low
Confidence	High		High	High

Mitigation:

- Implement a buffer zone around the wetland (see Section 11). The buffer and the delineated wetland area should be considered as a No-Go area for construction activities (apart from construction of stormwater infrastructure (e.g headwall outlets, gabions etc.).
- Laydown areas and stockpiles must all be located outside of the delineated wetland area and its associated buffer.

Impact 2: Sedimentation of artificial wetland habitat caused by erosion due to clearance of vegetation.

Clearing of vegetation in order to prepare the site will expose soil, making it vulnerable to erosion, which can cause sedimentation of the wetland. Given the relatively flat profile of the site and the sandy texture of the soil, the intensity of this impact is not expected to be very high.

	Alternative 1		Alternative 2	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very low	Low	Very low
Duration	Short term	Brief	Short term	Brief
Extent	Limited	Very limited	Limited	Very limited
Probability	Likely	Unlikely	Likely	Unlikely
Significance	-40	-15	-40	-15
Reversibility	High	High	High	High
Irreplaceability	Low	Low	Low	Low
Confidence	High	High	High	High

Mitigation:

- Ensure that construction activities do not cause any preferential flow paths and concentrated surface runoff during rainfall events.

- Implement a buffer zone around the wetland (see Section 11). The buffer and the delineated wetland area should be considered as a No-Go area for construction activities.
- Reduce transport of sediment through use silt fences that must be placed around the outside of the buffer zone.
- Clearly demarcate the construction area and ensure that heavy machinery does not compact soil or disturb vegetation outside of these demarcated areas.
- Revegetate exposed areas once construction has been completed.

10.1 Operational Phase

Impact 3: Degradation of wetland habitat and alteration of the hydroperiod of the artificial wetland caused by increased stormwater input into the wetland.

The hydroperiod is likely to change as a result of the stormwater inputs and will most likely result in longer periods of saturation and inundation. The artificial wetland habitat is therefore expected to become more enhanced, which will likely lead to a transition to more seasonal to permanent wetland habitat. Given the wetland is artificial, this alteration of the hydroperiod is not considered as a significant impact. High energy, high volume stormwater inputs can also cause degradation of the wetland due to alteration of flow paths and erosion of the wetland.

	Alternative 1		Alternative 2	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low	Low	Very Low
Duration	Ongoing	Ongoing	Ongoing	Ongoing
Extent	Limited	Very Limited	Limited	Very Limited
Probability	Likely	Unlikely	Likely	Unlikely
Significance	**-55: Minor**	**-27: Negligible**	**-55: Minor**	**-27: Negligible**
Reversibility	High	High	High	High
Irreplaceability	Low	Low	Low	Low
Confidence	High	High	High	High

Mitigation:

- Rainwater harvesting tanks must be installed where feasible – both as a water conservation and stormwater management strategy;
- Use of swales and detention ponds to attenuate stormwater runoff, encourage infiltration and reduce the speed, energy and volumes at which stormwater is discharged from the site;
- Use of permeable paving to encourage infiltration into the soil;
- Headwall outlets discharging into the wetland must include energy dissipation (e.g. stilling basin) and erosion protection (e.g. reno mattress).

Impact 4: Pollution of artificial wetland habitat caused by litter and disposal of hazardous products into the stormwater system.

Pollutants (e.g. oil, paint, discarded pesticides etc.) are often disposed into stormwater systems which can pollute wetlands and rivers. Given the endorheic nature of the artificial wetlands on site, they are relatively sensitive to pollution.

	Alternative 1		Alternative 2	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Moderate	Low	Moderate	Low
Duration	Ongoing	Short term	Ongoing	Short term
Extent	Limited	Very limited	Limited	Very limited
Probability	Likely	Probably	Likely	Probably
Significance	**-60: Minor**	**-28: Negligible**	**60: Minor**	**-28: Negligible**
Reversibility	High	High	High	High
Irreplaceability	Low	Low	Low	Low
Confidence	High	High	High	High

Mitigation:

- Visible signage and lease agreements must clearly prohibit the disposal of pollutants into the stormwater system. The stormwater system must only accommodate surface runoff following rainfall.
- Oil water separators must be installed in areas where storage, spillage and or use of hydrocarbons is expected to be relatively high (e.g. warehouses).
- Adequate waste disposal bins must be provided on site.

Impact 5: Invasion of artificial wetland by alien invasive plant species.

For Alternative 1, the planned open space occurs through an area that is currently quite disturbed with a relatively high abundance of weedy species. The density of established indigenous vegetation is relatively low compared with other parts of the site and the likelihood of dense thickets of alien invasive plant species establishing in the designated open space area is relatively high.

For Alternative 2, while alien invasives are present throughout the wetland, indigenous vegetation is quite well-established and the density of invasion is currently relatively low. It is possible that these invasives may become more dominant over time, particularly due to disturbance of soils during the construction process. Alien invasives currently established within the wetland can be controlled with relatively low effort.

	Alternative 1		Alternative 2	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Intensity	Moderate	Low	Low	Very low
Duration	Ongoing	Ongoing	Ongoing	Ongoing
Extent	Limited	Very limited	Limited	Very limited
Probability	Likely	Unlikely	Likely	Unlikely
Significance	**-60: Minor**	**-30: Negligible**	**-55: Minor**	**-27: Negligible**
Reversibility	High	High	High	High
Irreplaceability	Low	Low	Low	Low
Confidence	High	High	High	High

Mitigation:

- Implement an alien invasive control plan to remove current invasive species and prevent their further spread. Relevant alien invasive plant (AIP) species must be identified by a suitably qualified ecologist or botanist.
- AIPs must be controlled using the cut-stump method – cutting the main stem close to the ground and applying a suitable, registered herbicide to the freshly cut stump.
- AIPs must NOT be controlled using a foliar herbicide.

- Felled plants must be removed from the wetland area.
- Follow up control must be implemented annually until AIPs have been eradicated. Follow up inspections must be undertaken annually.

11. BUFFER DETERMINATION

Determination of a suitable buffer assumed the implementation of mitigation measures recommended in the impact assessment. The characteristics of the catchment and buffer that were used as input into the buffer tool are summarised as follows:

- It was assumed that the mitigation measures recommended in the impact assessment will be implemented.
- Only buffers for Wetland A and B were determined.
- Mean Annual Precipitation Class: 600 - 800 mm.
- Rainfall Intensity: Zone 4 (Very High).
- The inherent runoff potential of soil in the catchment area is low (A/B soils).
- Average slope of the catchment contributing to the wetland is <10 %.
- Inherent erosion potential of the catchment soils is moderate (K factor 0.5 – 0.7).
- The slope of the buffer area is flat (< 2 %).
- Interception characteristics of the vegetation is considered to be ideal (i.e. robust vegetation is present with relatively high interception potential.

Based on these inputs, the buffer for Wetlands A and B was set to 10 m. It is recommended that all construction activities should remain outside of the wetlands and the buffer. Exceptions to this requirement are the upgrading of the road passing through the eastern extent of the buffer of Wetland A and any construction of stormwater headwall outlets directing surface runoff into the wetlands.

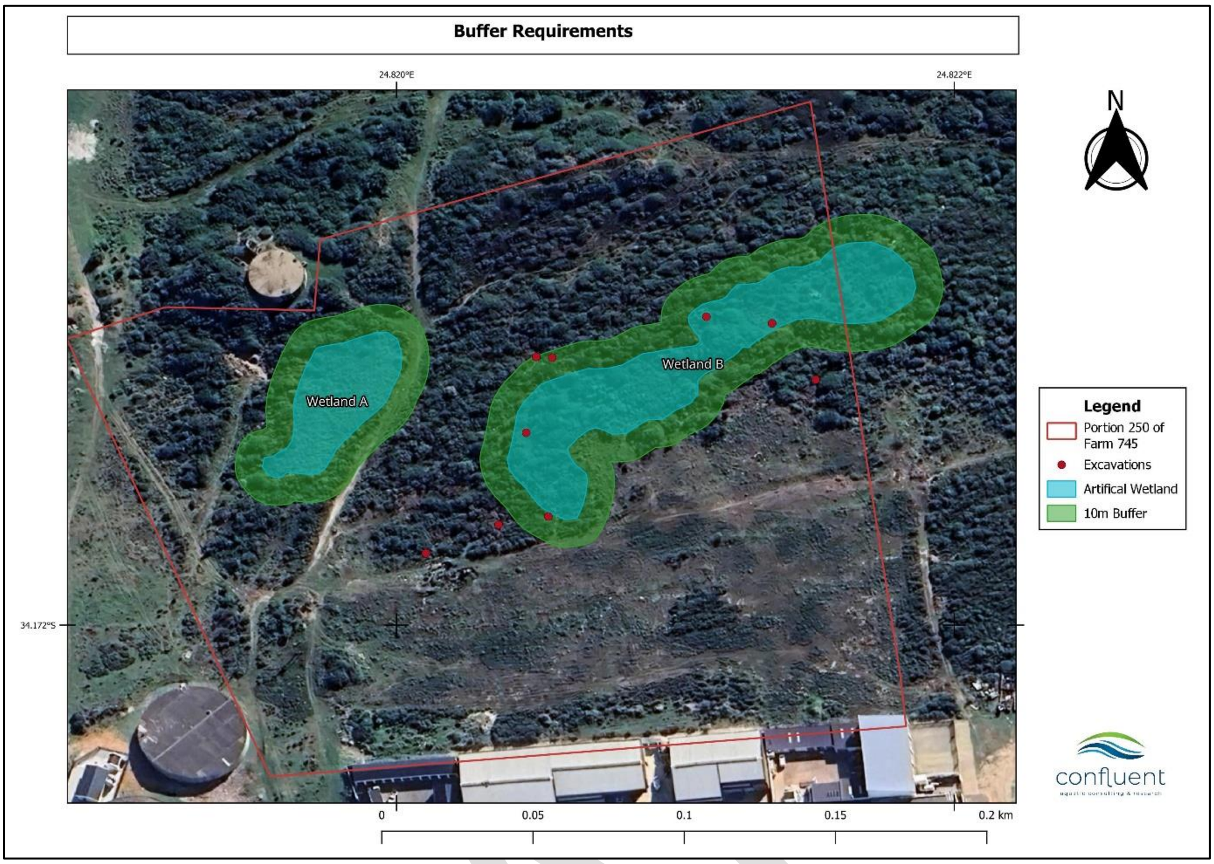

Figure 21: Map indicating delineated wetlands and recommended 10 m buffers.

12. CONCLUSION

The combination of the desktop survey, analysis of historical imagery and site visit found no evidence of the presence of any natural watercourses on the property. All observed wetlands on site are considered to be artificial. While the ecological importance of these artificial wetlands is low, they are moderately important in terms of their hydro-functional attributes and could provide a useful function with respect to attenuating stormwater runoff. Furthermore, they do currently provide habitat for a local diversity of amphibian and bird species. For this reason, it is recommended that Wetland A and Wetland B be retained and incorporated into the planned open space of the development as a stormwater attenuation area. Alternative 2, as proposed in this study is therefore recommended as the preferred alternative. Under this alternative, impacts are negligible (assuming implementation of mitigation measures) and represents a more ecologically sensitive option in comparison to Alternative 1, which will result in loss of most of the current area of Wetland B. Given their very limited ecological importance and sensitivity, the loss of any of the small excavations that fall outside of the buffer for Wetland A and B is considered to be acceptable from a freshwater biodiversity perspective. As the wetlands are artificial no water use authorisation is required.

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APPENDIX 1: ECOLOGICAL IMPORTANCE & SENSITIVITY METHOD

The ecological importance of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales (Duthie, 1999). Ecological sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Duthie, 1999). The Ecological Importance and Sensitivity (EIS) provides a guideline for determination of the Ecological Management Class (EMC).

The revised method for the determination of the EIS of a wetland considers the three following ecological aspects (Rountree et al., 2013):

Ecological importance and sensitivity

- Biodiversity support including rare species and feeding/breeding/migration;
- Protection status, size and rarity in the landscape context;
- Sensitivity of the wetland to floods, droughts and water quality fluctuations.

Hydro-functional importance

- Flood attenuation;
- Streamflow regulation;
- Water quality enhance through sediment trapping and nutrient assimilation;
- Carbon storage

Direct human benefits

- Water for human use and harvestable resources;
- Cultivated foods;
- Cultural heritage;
- Tourism, recreation, education and research.

Each criterion is scored between 0 and 4, and the average of each subset of scores is used to derive a score for each of the three components listed above. The highest score is used to determine the overall Importance and Sensitivity category of the wetland system (Table 4).

Table 4: Ecological importance and sensitivity categories. Interpretation of average scores for biotic and habitat determinants.

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

APPENDIX 2 - IMPACT ASSESSMENT METHODOLOGY

Individual impacts for the construction and operational phase were identified and rated according to criteria which include their intensity, duration and extent. The ratings were then used to calculate the consequence of the impact which can be either negative or positive as follows:

Consequence *= type x (intensity + duration + extent)*

Where type is either negative (i.e. -1) or positive (i.e. 1). The significance of the impact was then calculated by applying the probability of occurrence to the consequence as follows:

Significance *= consequence x probability*

The criteria and their associated ratings are shown in Table 5.

Table 5: Categorical descriptions for impacts and their associated ratings

Rating	Intensity	Duration	Extent	Probability
1	Negligible	Immediate	Very limited	Highly unlikely
2	Very low	Brief	Limited	Rare
3	Low	Short term	Local	Unlikely
4	Moderate	Medium term	Municipal area	Probably
5	High	Long term	Regional	Likely
6	Very high	Ongoing	National	Almost certain
7	Extremely high	Permanent	International	Certain

Categories assigned to the calculated significance ratings are presented in Table 6.

Table 6: Value ranges for significance ratings, where (-) indicates a negative impact and (+) indicates a positive impact

Significance Rating	Range	
Major (-)	-147	-109
Moderate (-)	-108	-73
Minor (-)	-72	-36
Negligible (-)	-35	-1
Neutral	0	0
Negligible (+)	1	35
Minor (+)	36	72
Moderate (+)	73	108
Major (+)	109	147

Each impact was considered from the perspective of whether losses or gains would be irreversible or result in the irreplaceable loss of biodiversity of ecosystem services. The level of confidence was also determined and rated as low, medium or high (Table 7).

Table 7: Definition of reversibility, irreplaceability and confidence ratings.

Rating	Reversibility	Irreplaceability	Confidence
Low	Permanent modification, no recovery possible.	No irreparable damage and the resource isn't scarce.	Judgement based on intuition.
Medium	Recovery possible with significant intervention.	Irreparable damage but is represented elsewhere.	Based on common sense and general knowledge
High	Recovery likely.	Irreparable damage and is not represented elsewhere.	Substantial data supports the assessment

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ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS & TOURISM

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST IN TERMS OF REGULATIONS 12 AND 13 OF THE AMENDMENTS TO THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED.

	(For official use only)
File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for environmental authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amendments to the Environmental Impact Assessment Regulations, 2014. This form is valid as of 6 January 2021.

PROJECT TITLE

The Proposed Development of a new warehouse and storage facility on Portion 250 of Farm 745, Goedgeloof, St Francis Bay, Eastern Cape

SPECIALIST [1]			
Contact person:	JAMES DABROWSKI		
Postal address:	7 ST. JOHNS STREET, DORMEHLSDRIFT, GEORGE		
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Professional affiliation(s) (if any)	SACNASP (Pr. Sci. Nat.)		

Project Consultant:	Eco Route Environmental Practitioners		
Contact person:	Joclyn Marshall (EAPASA No. 2022/5006)		
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	SEDGEFIELD	Cell:	072 126 6393
Postal code:	6573		
Telephone:		Fax:	
E-mail:	joclyn@ecoroute.co.za		

4.2 The SPECIALIST

I, JAMES DABROWSKI, declare that –

General declaration:

- I act as the independent Specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation **8** of the regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by

interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;

- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended.
- I have a vested interest in the proposed activity proceeding, such vested interest being:

____

____

Signature of the environmental assessment practitioner:

CONFLUENT ENVIRONMENTAL

Name of company:

CONFLUENT ENVIRONMENTAL

Date:

Signature of the Commissioner of Oaths:

72615958
CST PAPERS

Date:

2024-04-25

Designation: CONSTABLE

[1] Curriculum Vitae (CV) attached

Official stamp (below).

SUID-AFRIKAANSE POLISIEDIENS
STATION COMMANDER
COMMUNITY SERVICE CENTRE
2024 -04- 25
GEORGE
SOUTH AFRICAN POLICE SERVICE

Annexure 1

CV

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DOB:	20 July 1976
Marital Status:	Married
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TERTIARY EDUCATION

2002–2004: Ph.D.: Freshwater Research Unit, Department of Zoology, University of Cape Town

2000–2001: M.Sc. (Cum Laude): Department of Zoology, University of Stellenbosch

1999: B.Sc. Honours: Department of Zoology, University of Stellenbosch

1996-1998: B.Sc. in Zoology and Botany, University of Stellenbosch

EMPLOYMENT RECORD

Present: **Confluent Environmental - Co-Director:** Established the company Confluent Environmental with the purpose of providing biodiversity consulting and research services to the agricultural, industrial, mining, tourism and private sectors in South Africa and the rest of Africa, including conducting specialist aquatic and water resource studies for environmental assessments as required by national and international legislation.

2006-2017: **CSIR (Natural Resources and Environment) – Principal Researcher:** Responsible for attracting funding and conducting research in the field of water quality and environmental chemistry, aquatic ecotoxicology and catchment modelling within the Water Ecosystems Research Group

2004-2006: **Department of Water Affairs and Forestry - Specialist Scientist:** Responsible for the development of procedures to assess toxicological quality and aquatic ecosystem integrity, provide scientific and technical advice on water resource quality management and development, design and implementation of the National Toxicity Monitoring Programme (NTMP), derivation of water quality guidelines for toxicants in support of the NTMP and training and capacity building of junior staff and scientists.

2002-2004: **University of Cape Town - Scientific Officer:** PhD research work on the occurrence, mitigation and risk assessment of pesticides in the Lourens River, Western Cape, South Africa. Supervision of Honours and Masters students and lecturing in aquatic ecotoxicology and aquatic biogeochemical cycling.

KEY AREAS OF EXPERTISE

- Aquatic Biodiversity and Biomonitoring Surveys (Macroinvertebrates, Fish and Riparian and In-stream Habitat),
- Wetland Health Assessments,
- Estuarine Assessments,
- Wetland and Riparian Habitat Delineation,
- Aquatic Ecotoxicology,
- Ecological Risk Assessment,
- Interpretation and Analysis of Water Quality Data,
- Water Quality Guideline Development,
- Geospatial Mapping and Analysis,
- Catchment-scale Hydrological and Pollution Modelling;
- Project Management and Logistics.

PROFESSIONAL ASSOCIATIONS & OTHER QUALIFICATIONS

Research Affiliations

- Research Associate: Sustainability Research Unit, Nelson Mandela Metropolitan University
- Research Associate: Freshwater Research Centre

Professional Societies

- Society for Environmental Toxicology and Chemistry (SETAC)
- International Water Association (IWA)
- South African Council for Natural Scientific Professionals (SACNASP)

Scientific Review

- Associate editor: Bulletin for Environmental Toxicology and Chemistry
- Proposal reviewer: Water Research Commission and National Research Foundation
- Reference Groups: Water Research Commission

RELEVANT TRAINING

- River Health Ecostatus Models: 2006 (Department of Water Affairs and Forestry)
- Soil Water Assessment Tool (SWAT): (Stellenbosch University - July 2012)
- Water Governance in South Africa: Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on Water Use License Applications and Integrated Water and Waste Management Plans: 2018 (CBSS Training)
- Wetland Management: Introduction and Delineation (Centre for Environmental Management, University of the Free State) – November 2018
- WRSM/PITMAN and WR2012 Website Information System Water Resources (Allan Bailey – September 2020)

SELECTED PROJECT EXPERIENCE

- **An integrated approach to managing and mitigating the risk of agricultural nonpoint source pesticide pollution to the aquatic environment (South Africa).** *(Project Manager & Aquatic Ecotoxicologist)* Develop monitoring, modelling and risk assessment approaches to identify specific management and farming practices aimed at reducing the impact of waterborne agricultural chemicals on water resources. *Client: Water Research Commission (2017-2022).*

- **Development of a Reservoir Management Plan for Swakoppoort Dam (Namibia).** (*Project Manager & Water Quality Specialist)* Recommendation of remediation measures and the development of a catchment management plan to control eutrophication in a critical water supply dam in Namibia. *Client: NamWater (2019-2021).*
- **Human health risk assessment of pesticides applied in the Sundays River Valley (Eastern Cape, South Africa).** Monitoring and human health risk assessment of spray drift of agrochemicals. *Client: Sundays Organic Growers Association (2019-2020)*.
- **Aquatic biomonitoring, Benga Coal Mine, Mozambique.** *(Freshwater Ecologist).* Routine biomonitoring and water quality analysis of temporary wetlands impacted by coal mining. *Client: International Coal Ventures Limited (2018-2019).*
- **Ecological baseline update and customised biodiversity offest plan, New Liberty Gold Mine Liberia.** *(Freshwater Ecologist).* Aquatic biodiversity survey and water quality analysis to identify suitable freshwater offsets for a gold mine. *Client: Avesoro (2018-2019).*
- **Incorporating environmental fate models into risk assessment for pesticide registration in South Africa.** *(Project Leader)* Development of an improved aquatic risk assessment framework that integrates exposure and hazard for the purpose of registering pesticides for agricultural use in South Africa. Client: *Water Research Commission (2016-2019)*.
- **Development of ecological risk assessment tools for protection of ecosystem health.** *(Project Manager and Technical Lead)* Development and application of risk indicators, passive samplers and catchment modelling approaches to protect aquatic ecosystem health form agrochemical use, with a case study on the endangered Twee River Redfin (*Barbus erubescens*). *Client: CSIR (2015-2017).*
- **Quantifying and managing agricultural non-point source (NPS) nutrient pollution from field to catchment scale.** *(Principal Researcher)* Responsible for application of the SWAT model in the middle Olifants catchment and student supervision. *Client: Water Research Commission (2015-2018).*
- **Revision of the 1996 South African Water Quality Guidelines: Development of risk-based approach using irrigation water use as a case study.** *(Ecotoxicologist).* Responsible for development of irrigation guidelines for herbicides. *Client: Water Research Commission (2014-2016).*
- **Investigation of the contamination of water resources by agricultural chemicals and the impact on environmental health.** (*Project Project Manager & Aquatic Ecotoxicologist)* Risk assessment of agro-chemicals (including fertilizers and pesticides) on human and environmental health, including prioritizing pesticides for human health effects and development of pesticide use maps for South Africa. *Client: Water Research Commission (2010-2015).*
- **AquaBASE: Understanding and managing freshwater ecosystems in South Africa.** *(Project Manager & Water Quality Specialist).* Modelling the network of relationships between freshwater management options, ecological features and biophysical processes to produce "ecological production functions" that allow for the quantification of ecosystem services needed to restore water quality in the Upper Olifants River catchment of South Africa. *Client: CSIR (2012-2014).*
- **Linking land use to water quality for effective water resource and ecosystem management.** *((Project Manager & Water Quality Specialist)* Development of a decision support system aimed at facilitating decisions on how changes on land use impact on water quality and aquatic ecosystem health. *Client: Water Research Commission (2010-2013).*
- **Land use practices that sustain water resources: Eutrophication.** *(Water Quality Specialist)* Identification and testing of highly feasible solutions that will restore water resource quality with respect to eutrophication. *Client: CSIR (2010-2012).*
- **An overview of water quality and the causes of poor water quality in the Olifants River catchment, South Africa.** (*Water Quality Specialist)*. Analysis of water quality data and development of maps. *Client: Water Research Commission (2010-2011).*
- **Risk assessment of pollution associated with coal mining, agriculture and sewage in surface waters of the upper Olifants River system: Implications for aquatic ecosystem health and the health of human users of water.** *(Water Quality Specialist)* Water quality monitoring, analysis and

interpretation. Included application of the Soil Water Assessment Tool (SWAT) to estimate spatial and temporal sources of nutrient pollution leading to eutrophication in *Client: Coaltech (2009-2013).*

- **Development of a risk indicator methodology to estimate the relative risk of pesticide contamination in South African water resources.** (*Project Manager & Aquatic Ecotoxicologist*): Predicting the relative impacts of pesticides on the aquatic environment through the integration of application, toxicity and physicochemical data of pesticides, together with site-specific geographic and climatic characteristics. *Client: Water Research Commission (2008-2009).*
- **Waterberg Aquatic Baseline Study** (*Water Quality Specialist*): Characterisation of the Waterberg aquatic ecosystem and development of water quality indicators in anticipation of future coal mining developments in the region. *Client: ESKOM (2008-2009).*
- **Water and Agriculture for Food Security** (*Project Manager and Senior Researcher*). Investigation of the impact of agriculture on water use and water quality, with an emphasis on including water quality in virtual water trading and water footprinting. *Client: CSIR (2006-2008).*
- **Water Quality Monitoring Data and Target Users: Maximising Value (***Water Quality Specialist*) Recommendations for optimal information transfer mechanisms to realise the full value of water quality monitoring in a number of scenarios relevant to Southern Africa. *Client: Water Research Commission (2007-2008).*
- **South African Mercury Assessment Programme** (*Aquatic Ecotoxicologist*): Assessment of mercury in South African water resources and the compilation of an inventory detailing mercury emissions from coal-fired power stations in South Africa. *Client: CSIR (2006-2008).*
- **National Toxicity Monitoring Programme** (*Aquatic Ecotoxicologist*). Development of a national monitoring programme and aquatic ecosystem water quality guidelines (based on the methods used to develop ANZECC & ARMCANZ water quality guidelines) for organic pollutants in support of the National Toxicity Monitoring Programme. *Client: Department of Water Affairs and Forestry (2006-2008).*
- Extensive experience in (over 50 projects since 2018) conducting specialist freshwater ecology and biomonitoring studies for environmental and water use authorisation projects throughout South Africa (a comprehensive list can be provided upon request).

PUBLICATIONS – Guidelines & Scientific Reports

Dabrowski, J.M. (2022) An Integrated Approach to Managing and Mitigating the Risk of Agricultural Nonpoint Source Pesticide Pollution to the Aquatic Environment (2022). Volume 1: Research Report. WRC Report No.: 2707/1/22. Water Research Commission, Pretoria.

Dabrowski, J.M. (2022) An Integrated Approach to Managing and Mitigating the Risk of Agricultural Nonpoint Source Pesticide Pollution to the Aquatic Environment (2022). Volume 2: Development of risk maps and a risk indicator for identifying hotspots and prioritising risks of pesticide use to aquatic ecosystem health. WRC Report No.: TT 885/22. Water Research Commission, Pretoria.

Stewart, W., Bahindwa, A., Adams, A., Nzimande, M., Daniels, F., Job, N. and **Dabrowski, J.M**. (2021). Ecosystem Environmental Assessment Guideline: Guidelines for the implementation of the Terrestrial and Aquatic Ecosystem Protocols for environmental impact assessments in South Africa.

Dabrowski, J.M. (2015) Investigation of the Contamination of Water Resources by Agricultural Chemicals and the Impact of Environmental Health. Volume 1: Risk Assessment of Agricultural Chemicals to Human and Animal Health. WRC Report No.: TT 642/15. Water Research Commission, Pretoria.

Dabrowski, J.M. (2015) Investigation of the Contamination of Water Resources by Agricultural Chemicals and the Impact of Environmental Health Volume 2: Prioritizing human health effects and mapping sources of Agricultural pesticides used in South Africa. WRC Report No.: TT 642/15. Water Research Commission, Pretoria.

SCIENTIFIC PUBLICATIONS – Peer Reviewed Journals

Petersen, F., **Dabrowski, J.M.**, and Forbes, P.B.C. (2017). Identifying potential surface water sampling sites for emerging chemical pollutants in Gauteng Province, South Africa. *Water SA*, 43(1), 153-165.

Dabrowski, J., Baldwin, D.S., **Dabrowski, J.M.,** Hill, L., and Shadung, J. (2017). Impact of temporary desiccation on the mobility of nutrients and metals from sediments of Loskop Reservoir, Olifants River. *Water SA*, 43(1), 7-16.

Stehle, S, **Dabrowski, J.M.,** Bangert U. and Schulz R. (2016). Erosion rills offset the efficacy of vegetated buffer strips to mitigate pesticide exposure in surface waters. *Science of the Total Environment.* 545-546: 171-183.

Nsibande, S.A., **Dabrowski, J.M.**, van der Walt, E., Venter, A. and Forbes, P.B.C. (2015). Validation of the AGDISP model for predicting airborne atrazine spray drift: A South African ground application case study. *Chemosphere* 138: 454-461.

Dabrowski, J.M. (2015) Development of pesticide use maps for South Africa. *South African Journal of Science.* 111:1-7*.*

Dabrowski, J.M., Dabrowski, J., Hill, L., MacMillan, P. and Oberholster, P.J. (2014) Fate, transport and effects of pollutants originating from acid mine drainage in the Olifants River, South Africa. *River Research and Applications.* DOI: 10.1002/rra.2833.

Dabrowski, J.M. (2014) Applying SWAT to predict ortho-phosphate loads and trophic status in four reservoirs in the upper Olifants catchment, South Africa. *Hydrology and Earth System Sciences* 14: 2629-2643.

Dabrowski, J.**,** Oberholster, P.J. and **Dabrowski, J.M.** (2014) Water quality of Flag Boshielo Dam, Olifants River, South Africa: Historical trends and impact of drought. *Water SA* 40:345-358.

Dabrowski, J.M., Shadung J. and Wepener, V. (2014) Prioritizing agricultural pesticides used in South Africa based on their environmental mobility and potential human health effects. *Environment International* 62: 31-40.

Dabrowski J., Oberholster P.J., **Dabrowski J.M.,** Le Brasseur J. and Gieskes J. (2013) Chemical characteristics and limnology of Loskop Dam on the Olifants River (South Africa), in light of recent fish and crocodile mortalities. *Water SA* 39(5): 675-686.

Dabrowski, J.M. and Balderacchi M. (2013) Development and field validation of an indicator to assess the relative mobility and risk of pesticides in the Lourens River catchment, South Africa. *Chemosphere* 93(10): 2433-2443.

Dabrowski, J.M. and De Klerk, L.P. (2013) An assessment of the impact of different land use activities on water quality in the upper Olifants catchment. *Water SA* 39(2): 231-244

Masekoameng, K.E., Leaner, J.J and **Dabrowski, J.M.** (2010) Trends in anthropogenic mercury emissions estimated for South Africa during 2000-2006. *Atmospheric Environment*. 44(25): 3007-3014.

Dabrowski, J.M., Ashton, P.J. and Masekoameng, E. (2009) Analysis of Virtual Water Flows Associated with the Trade of Maize in the SADC Region: Importance of Scale. *Hydrological and Earth System Sciences.* 13: 1-11.

Dabrowski, J.M., Ashton, P.J., Murray, K., Leaner, J.J. and Mason, R.P. (2008) Anthropogenic mercury emissions in South Africa: coal combustion in power plants. *Atmospheric Environment* 42: 6620-6626.

Dabrowski, J.M., Murray, K., Ashton, P.J. and Leaner, J.J. (2009) Agricultural impacts on water quality and implications for virtual water trading decisions. *Ecological Economics.* 68: 1074-1082.

Dabrowski, J.M., Bollen, A., Bennett, E.R., and Schulz, R. (2006) Mitigation of azinphos-methyl in a vegetated stream: Comparison of runoff and spray drift. *Chemosphere* 62 (2), 204-212.

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Dabrowski, J.M., Bollen, A. and Schulz, R. (2005) Interception of azinphosmethyl by emergent aquatic macrophytes: Potential spray drift mitigation in agricultural surface waters. *Agriculture, Ecosystems and the Environment.* 111, 340-348*.*

Dabrowski, J.M. and Schulz, R. (2003) Predicted and measured levels of azinphos-methyl in the Lourens River, South Africa: Comparison of runoff and spray drift. *Environmental Toxicology and Chemistry.* 22 (3) 494-500.

Schulz, R., Hahn, C., Bennett, E.R., **Dabrowski, J.M.,** Thiere, G., & Peall, S.K.C. (2003) Fate and effects of azinphos-methyl in a flow-through wetland in South Africa. *Environmental Science and Technology*, 37 2139-2144.

Dabrowski, J.M., Peall, S.K.C., van Niekerk, A., Reinecke, A.J., Day, J. and Schulz, R. (2002) Predicting runoff-induced pesticide input in agricultural sub-catchment surface waters: linking catchment variables and contamination. *Water Research* 36 4975-4984.

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